U. S. DEPARTMENT OF ENERGY
WORK BREAKDOWN STRUCTURE DICTIONARY
PART II - ELEMENT DEFINITION

1. PROJECT TITLE/PARTICIPANT	2. DATE	3. IDENTIFICATION NUMBER
Environmental Management/Bechtel Jacobs Company LLC	10/18/02	DE-AC05-98OR22700

4. WBS ELEMENT CODE	5. WBS ELEMENT TITLE
.04.01.01.15	PAD Groundwater C-400 Action

6. INDEX LINE NO.	7. REVISION NO. AND AUTHORIZATION	8. DATE
N/A	Rev 5	04/17/03

9. APPROVED CHANGES
N/A

10. SYSTEM DESIGN DESCRIPTION	11. BUDGET AND REPORTING NUMBER
N/A	N/A

12. ELEMENT TASK DESCRIPTION

WBS GRAPH

See attached.

INTRODUCTION

In 1988, widespread contamination of groundwater by trichloroethene (TCE) and technetium-99 (Tc-99) around the Paducah Gaseous Diffusion Plant (PGDP) was detected. In 1993 an engineering cost estimate was approved and established a water policy box to protect the public from use of impacted groundwater. In 1995 and 1997 interim measures were taken to contain the high concentration areas of the Northwest and Northeast plumes. The interim measures included installation of two groundwater pump and treatment (P&T) systems, one each at the Northwest and Northeast plumes. Subsequently, remedial investigations were performed to determine the extent of groundwater contamination at PGDP. Results of these investigations detected the presence of dense non-aqueous phase liquid (DNAPL) onsite and up to four dissolved-phase plumes (northeast, northwest, southwest, and Technetium-99 plume) outside the facility fenceline. As a result of the remedial investigations and baseline risk assessment performed for the groundwater operable unit (GWOU), the following groundwater problem statements have been developed.

- Analytical data suggested that TCE exists as DNAPL at the C-400 Building area. TCE is found in both the upper continental recharge system (UCRS) and the regional gravel aquifer (RGA) at the C-400 (decontamination) Building. The TCE DNAPL must be reduced, removed, or contained before it is possible to return the groundwater back to beneficial use.
- TCE and its degradation products exist at lower concentrations throughout the plumes both on and off U. S. Department of Energy (DOE) property. These dissolved concentrations need to be reduced before the groundwater at or around the PGDP can be brought back to beneficial use.
- Dissolved-phase TCE and Tc-99 are discharging to surface water in Little Bayou Creek in an off-site area. These releases need to be evaluated and then action taken if the risks indicate action is required.

DOE's strategy for groundwater restoration at PGDP assumes complete restoration is technically impracticable. Meaning that compliance with Applicable or Relevant and Appropriate Requirements is impracticable from an engineering standpoint, particularly in relation to achieving a performance standard of reaching maximum contaminant levels in impacted groundwater. Therefore remedial action objectives for PGDP include 1) reducing imminent risk to human health and the environment, 2) establishing source control, whereby active sources to groundwater contamination are removed or are reduced to acceptable levels, 3) stopping plume growth by providing containment of contaminant migration, and 4) conducting monitored natural attenuation.

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To ensure that there are no imminent unacceptable risks, DOE established a water policy box to protect the public from use of impacted groundwater. Residences located within the policy box signed agreements and were provided potable water by the DOE. However, these agreements are expiring and attempts to renew the agreements have been meet with some resistance. To ensure long-term protectiveness of human health, institutional controls must be implemented within the water policy box and all areas impacted by groundwater contamination. Implementing institutional controls will supplement engineered cleanup actions and will provide a mechanism used to restrict inappropriate use of land, facilities, and environmental media by limiting exposure to residual contaminants left behind as part of a Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) or Resource Conservation and Recovery Act of 1976 (RCRA) remedy.

Establishing source control is complete when the design, construction, and operation of source remedial technology(s) are implemented. The focus of aggressive source removal at PGDP is the C-400 building area. Remedial investigations at PGDP have revealed that soil and groundwater at the C-400 building area contain the highest concentrations of TCE observed to date. Applying an aggressive remedial action technology(s) within this area will have the greatest impact on contaminant mass removal and risk reduction. Effective mass removal is predicted to accelerate the rate of natural attenuation of the remaining dissolved phased plumes downgradient and offsite of the PGDP.

Stopping plume growth, or containment, provides a means of minimizing the volume of groundwater impacted by contamination. The current P&T systems contain the high concentration areas of the Northwest and Northeast plumes. However, P&T systems typically are maintained for long periods and result in extremely high operation and maintenance costs. DOE is currently testing the C-Sparge™ technology as a dissolved phase plume action for plume containment. If successful, C-Sparge™ would be a more cost-effective containment technology.

Implementing institutional controls, and establishing source control and plume containment will ensure short-term and long-term protectiveness of human health, a reduction of the toxicity, mobility or volume of contaminants, and restoring groundwater to the most beneficial use. The final phase in groundwater restoration is implementing monitored natural attenuation. Monitored natural attenuation would be used to ensure protectiveness of human health and the environment and to measure the effectiveness of the cleanup strategy.

The scope of the Groundwater C-400 Action is to provide source control at the C-400 building area. The project is composed of 8 sub-project tasks. Work Breakdown Structure (WBS) element numbers assigned to the sub-project tasks are:

WBS 1.12.04.01.01.15.01 – Technical Management and Integration
WBS 1.12.04.01.01.15.02 – Characterization
WBS 1.12.04.01.01.15.03 – Decision Documents
WBS 1.12.04.01.01.15.04 – Six-Phase Heating Treatability Study
WBS 1.12.04.01.01.15.05 – Design
WBS 1.12.04.01.01.15.06 – Action Implementation
WBS 1.12.04.01.01.15.07 – Newly Generated Wastes
WBS 1.12.04.01.01.15.08 – DOE Prime

LOGIC RELATIONSHIPS

- The GWOU feasibility study, performed under separate WBS, identified and evaluated technology alternatives to remediate primary and secondary source areas, and dissolved-phase plume areas. Primary sources include DNAPL in the UCRS and secondary sources include DNAPL in the RGA. The C-400 building area includes both primary and secondary sources. Six-phase heating (SPH) is a direct heating technology under consideration for treating both primary source and secondary source areas. Dynamic

underground stripping (DUS) and chemical oxidation technologies are contingency technologies for treatment of secondary source areas.
- Groundwater C-400 Action is a source control remedy. The action employs engineering controls (direct heating) to reduce contaminant mass and expedite the natural attenuation process.
- Groundwater project provides groundwater modeling, characterization, and well replacement tasks. Modeling efforts support evaluation of site specific geochemical parameters which area used in determining cleanup goals for groundwater remedies. Characterization supports determining the nature and extent of groundwater contamination, and well replacement supports maintenance of the groundwater monitoring system at the PGDP.
- Disposal facility requirements will be identified and documented prior to mobilization.

SCOPE DESCRIPTION

The objectives of this subproject are to perform a CERCLA treatability study, source term remediation for C-400 source area to the GWOU, and to ultimately reduce contaminant mass to levels that are protective of human health and the environment. The scope to achieve the objectives includes procurement of a design build subcontract, conducting a design investigation for source term delineation, developing and submitting a Proposed Plan (PP), Record of Decision (ROD)/Land Use Controls Implementation Plan (LUCIP), Remedial Design (RD), Remedial Action Work Plan (RAWP), and Remedial Action implementation.

The following Solid Waste Management Units (SWMUs) are associated with the C-400 source area action.
Release Sites and Facilities

RAIMS No.	SWMU No.	Description	IDMS CODE
2076	11	C-400 Trichloroethylene Leak Site (GW)	136
2073	26	C-400 to C-404 Underground Transfer Line (GW)	155
2077	40	C-403 Neutralization Tank (GW)	138
2075	47	C-400 Technetium Storage Tank Area (GW)	139
2074	203	C-400 Sump (GW)	137

Past and Future Accomplishments

Past Accomplishments
04.01.01.15.04 – Six-phase Treatability Study
- Procurement of treatability study construction and performance subcontract
- Complete 100% Auditable Safety Analysis
- Complete Certified for Construction Design Drawings and Technical Specifications Package
- Initiate Construction of the Six-Phase Heating Treatability Study
- Complete Baseline Membrane Interface Probe (MIP) Characterization

Future Accomplishments

04.01.01.15.04 – Six-phase Treatability Study
- Complete Six-phase Heating Treatability Study Construction
- Support seismic tomography study of DNAPL
- Complete Six-phase Heating Treatability Study Operation & Maintenance
- Complete Six-phase Heating Treatability Study Completion Report

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04.01.01.15.06 – Action Implementation
- Complete D0, D1, and D2 Proposed Plan
- Regulatory approval of Proposed Plan
- Complete D0, D1, and D2 ROD/LUCIP
- Regulatory approval of ROD
- Procure a Design Build Subcontract
- Complete Planning Documents to Support Remedial Design Source Term Delineation
- Complete Source Term Delineation
- Complete the D0, D1, and D2 Remedial Design Work Plan.
- Obtain EPA/KY approval of the Remedial Design Work Plan.
- Complete the 30%, 60%, 90%, and certified for construction Remedial Design Report.
- Obtain regulatory approval of the Certified for Construction Design.
- Complete D0, D1, and D2 Remedial Action Work Plan
- Regulatory approval of D2 Remedial Action Work Plan
- Complete Preliminary Hazard Screening, Unresolved Safety Question Determination (USQD), and Draft and Final Auditable Safety Analysis
- Complete Draft and Final Project Execution Plan Per DOE Order 413.3
- Implement C-400 Source Remedial Action
- Complete D0, D1, and D2 Remedial Action Completion Report
- Install 12 Groundwater Monitoring Wells for Monitored Natural Attenuation

04.01.01.15.07 – C-400 Newly Generated Waste
- Management of Treatability Study Waste
- Dispose of waste within one year of generation

04.01.01.15.08 – C-400 DOE Prime
- DOE funding source for disposal of waste from the Treatability Study, Characterization, and Remedial Action

Scope Description

04.01.01.15.01 Technical Management and Integration

Technical Management and Integration activities include the technical, subcontract, and project management necessary to ensure that all activities in the WBS elements are completed on schedule, within budget, and without safety or environmental incident. Technical Management and Integration includes the Project Manager, Safety Advocate, Subcontract Technical Representative, and Project Controls personnel who will perform project management, subcontractor oversight, Environmental Safety and Health (ES&H) support, and project scheduling and estimating. Other Bechtel Jacobs Company (BJC)/Management & Integration (M&I) support activities will be captured in individual WBS elements.

Baseline Change Proposals – Prepare BCP documentation to make necessary corrections to the baseline when scope, schedule, or cost changes are determined necessary.

Specific activities include:

- Ensure completion of all activities within the subproject is in compliance with the principals of Integrated Safety Management
- Maintain contact and open communications with the appropriate DOE Project Manager on the subproject activities

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- Participate in biweekly technical information and monthly Project Status Review meetings to provide the DOE with project status summaries
- Manage the subcontracts and work authorizations issued to complete the work under the subproject
- Respond and supply information to DOE for Lessons Learned, surveillance and audits, Site-Specific Advisory Board support, and other DOE reporting mechanisms.
- Maintain the monthly subproject estimates and estimates at completion.

04.01.01.15.04 – Six-Phase Treatability Study
Complete the six-phase heating treatability study, which includes construction, operation, and data analysis and completion report. Construction includes drilling and installation of the remaining 3 electrode/vapor extraction well to an approximate depth of 97ft bgs, develop and install hardware to 4 multi-port groundwater monitoring wells, drilling and installation of 4 vacuum monitoring piezometers to an approximate depth of 58 ft bgs, and setup of the heating components and vapor extraction and treatment systems.

A seismic tomography study will be conducted in the six-phase heating study area and the area of the former permeable treatment zone treatability study. The seismic tomography study will utilize energy sources and hydrophones to create a 3-dimensional subsurface image of the study area. The objective of this study is to detect DNAPL in the subsurface. To accomplish this, surveys will be made before starting the six-phase system and then after completion of the treatability study. Differences between these two surveys may indicate removal or redistribution of DNAPL in the sub surface.

Complete startup, operation, shutdown, and equipment demobilization of the six-phase heating treatability study. Heating operation will occur in stages, and includes; the unsaturated UCRS; saturated UCRS; upper RGA; top of the McNairy; and the lower RGA. Startup is projected for 15 days, operation is for 130 days, and system cool down for 15 days. Complete post treatment conformation soil and groundwater sampling and analyses.

Following completion of the field work and data validation, the data will be evaluated and a recommendation for full scale deployment will be made to DOE.A completion report will be prepared to document the treatability study results and the interpretation of the generated data. The report will provide detailed descriptions of the construction, system startup and operation, project schedule, and will include construction system as-built drawings, and well completion diagrams. The report will evaluate the performance of the SPH system for groundwater plume remediation at the PGDP. The performance assessment will include specifically addressing cost effectiveness of the technology in the three physical settings of interest (1) unsaturated zone of the UCRS, (2) the saturated zone of the UCRS, and (3) the Regional Gravel Aquifer

04.01.01.15.06Action Implementation
Procure the Remedial Action Subcontract. This includes assembling the formation team, preparation of the request for proposal, conducting bid evaluations and awarding the subcontract.

Characterization includes primary and secondary source term delineation at the C-400 building area. Information obtained from this task will be used to complete the remedial design investigation for source term removal. Tasks include review of existing data, planning and implementing additional data acquisition to delineate primary and secondary source terms, and developing a source term delineation report.

Existing reports and data will be reviewed to confirm the conceptual model for the C-400 area, determine the location of suspected primary and secondary sources, and to identify data gaps and needs that would define or confirm the limits of the existing source terms. Existing reports and databases include, but are not limited to, the *Remedial Investigation Report for Waste Area Grouping 6 at the Paducah Gaseous Diffusion Plant Paducah, Kentucky*, May 1999, DOE/OR/07-1727/V1-V4 & D2, and the OREIS Database System for DOE Oak Ridge Operations.

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Based on the data review, planning documents would be prepared for additional data acquisition and evaluation to complete source term delineation. Remedial Design Investigation planning documents (D0, D1, and D2 submittals) include, but are not limited to, a work plan, and sampling and analyses, data management, quality assurance project, environmental safety and health, waste management, and security plans. Data acquisition would include determining the subsurface soil conditions and the presence and concentration of volatile organic compounds (VOCs) in the UCRS, RGA, and Upper McNairy formations. Employing a direct push technology, such as the MIP, can readily collect soil profile and VOC data from the UCRS. MIP can collect data in a short period of time and with minimal generation of investigative derived waste. Data from the RGA and McNairy formations would be collected using conventional drilling and soil and groundwater sampling methods.

The remedial design investigation scope includes 50 membrane interface probe (MIP) tests to 60 ft (UCRS), drilling with soil sampling 5 boreholes to 60 ft (UCRS), and drilling with soil and groundwater sampling 10 boreholes to 100 ft (RGA). A total of 120 soil samples and 80 groundwater samples will be submitted for chemical analyses. Chemical analyses include VOCs, and radionuclides.

Data would be analyzed, interpreted, and incorporated into a remedial design investigation report where the source terms are clearly defined and the areas of remedial action identified.

Complete D0, D1, and D2 Proposed Plan. The Proposed Plan will be developed consistent with Section XIV of the Federal Facility Agreement (FFA).

Complete D0, D1, and D2 ROD/LUCIP. The ROD includes: 1) description of the site conditions and background; 2) threats to public health or welfare or the environment, and statutory and regulatory authorities; 3) proposed actions and estimated costs; and 4) clean up criteria. The LUCIP will include, but not be limited to, identifying and current and future land use for the unit, identifying the necessary limitations on future land use, and identifying the types of controls and restrictions that will be implemented to achieve the land use control objectives.

Complete the D0, D1, and D2 Remedial Design Work Plan and obtain EPA/KY approval of the Remedial Design. Complete the 30%, 60%, 90%, and certified for construction Remedial Design Report and obtain regulatory approval of the Certified for Construction Design. Knowledge from 6-Phase Treatability Study will be used in the development of the design for Full Phase.

Complete the D0, D1, and D2 Remedial Action Work Plan for the C-400 Action.
Complete the D0, D1, and D2 Construction Quality Assurance Plan for the C-400 Action.
Mobilize for C-400 remedial action and finish remedial action.
Complete the construction/implementation of the electrical resistance heating for the C-400 area.. Construction of the system is estimated at six months. Operations and maintenance and systems monitoring of the remedial measures will begin after completion of construction. Systems operation is assumed at six months.
Complete the D0, D1, and D2 Operations and Maintenance Plan for the C-400 Action.
Implement the systems operations and maintenance.
Complete D0, D1, and D2 Post Construction Report for the C-400 Action.

The Remedial Action Work plan will also include the scope and technical specifications for applying monitored natural attenuation, and include the installation of 12 groundwater monitoring wells to support monitored natural attenuation. The D2 Remedial Action Work Plan will be submitted to KDEP and EPA for approval. After regulatory approval the D2 Remedial Action Work Plan will be placed into the Administrative Record file for public review.

Complete Preliminary Hazard Screening, USQD, and Draft and Final Auditable Safety Analysis.

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Complete Draft and Final Project Execution Plan (PEP) in accordance with DOE Order 413.3. The purpose of the PEP is to establish and define the plans, organization, systems, responsibilities, and guidelines to be used by the DOE in managing the C-400 remedial action project.

C-400 action implementation will be conducted in accordance with the approved Remedial Action Work Plan.

Conceptual remedy construction includes drilling and installing electrodes, vapor extraction wells, vacuum piezometers, groundwater monitoring wells, above grade system assembly, and soil and groundwater sampling and analyses. A total of 72 electrodes (50 @ SE & 22 @ SW corner C-400) to 110 ft, 144 vapor extraction wells (2 per electrode borehole) 48 vacuum monitoring piezometers to 60 ft, and 6 nested well clusters to 110 ft will be installed. Above grade system components include power control unit(s), condenser, displacement blower, heart exchanger, granular activated carbon units, dilution blower, and photo acoustic analyzer. Baseline soil sampling and analyses includes 400 soil samples (30 bh @ 12 smpls/bh + 40 QC) for VOCs and RAD analyses. Baseline groundwater sampling/analyses includes 24 samples (6 well nests * 3 wells/nest + 6 QC) for VOCs, metals, and radionuclides. Operational groundwater sampling/analyses includes includes 24 samples (6 well nests * 3 wells/nest + 6 QC) for VOCs, metals, and radionuclides. Post operation sampling/analyses includes 24 groundwater samples (6 well nests * 3 wells/nest + 6 QC) for VOCs, metals, and radionuclides, and 200 soil samples (15 bh @ 12 smpls/bh + 20 QC) for VOCs, moisture, and RAD analyses.

Operation of the three-phase full-scale deployment at the SE corner of C-400 will be complete in 30 weeks.

Complete the D0, D1, and D2 Remedial Action Completion report. This report will document all remedial action construction, startup, operation, and sampling and analyses activities with schedule, and provide lessons learned, and conclusions and recommendations.

04.01.01.15.07 – Newly Generated Waste
Management of all waste generated from the treatability study, characterization, and remedial action activities will be disposed within one year of generation.

04.01.01.15.08 – DOE Prime
DOE funding source for disposal of RCRA listed, hazardous, and non-hazardous waste generated from the treatability study, characterization, and remedial action activities. This includes, but is not limited to, soil, sludge, decontamination water, well development water, personal protective equipment, and miscellaneous sanitary waste.

Safety and Health Work Performance

It is the core value of BJC that the safety and health of every worker and the public at large, and our environment, are the most important assets we are entrusted to protect. To accomplish this, an Integrated Safety Management System (ISMS), based on DOE's ISMS has been implemented that incorporates the five core functions and is based on the seven guiding principles. The objective of ISMS is to systematically integrate safety and environmental protection into the planning and execution of all work activities. The term safety encompasses Nuclear Safety, Industrial Safety, Industrial Hygiene, Occupational Health, Health Physics, and environmental issues. ISMS requirements flow-down to BJC subcontractors. The Five Core Functions are: (1) Define the scope of work, (2) Analyze hazards, (3) Develop and implement hazard controls, (4) Perform work within controls, and (5) Provide feedback and continuous improvement. The Seven Guiding Principles are (1) Line Management Responsibility for Safety, (2) Clear Roles and Responsibilities, (3) Competence commensurate with responsibility, (4) Balanced Priorities, (5) Identification of Safety Standards and Requirements, (6) Hazard Control Tailored to Work Being Performed, and (7) Operations Authorization

In performing the analysis of alternatives against the CERCLA nine criteria, consideration is given to the

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principles of ISMS. Specifically, in the analysis of "implementability" and "short-term impact", a trade-off assessment is performed to balance the risk to workers compared to the overall benefit of the project. This assessment follows the five core functions of ISMS to assure that the scope of work and the specific steps to carry out the project have been defined in sufficient detail to analyze the associated hazards, the effectiveness of the controls, and the actual risks to the workers.

Before a subproject begins, several activities must be completed that demonstrate that all involved in the project have completed rigorous health and safety reviews and that all potential hazards of doing the work have been identified. An Unresolved Safety Question Determination (USQD) was performed for the six-phase heating treatability study. The USQD identified the potential for release of hazardous substances (TCE) above reportable quantities (RQs) listed in 40 CFR 302, Appendix B, which was further evaluated by performance of an Auditable Safety Analysis (ASA). Results of the ASA determined radiological hazards were either insignificant compared to background, or the inventory of radionuclides is less the RQs listed in 40 CFR 302, Appendix B, and classified the non-radiological hazards for this facility as low. The routine activities in the C-400 action scope are conducted in accordance with standard operating procedures, activity hazard analyses, and Integrated Safety Management plans. Non-routine work will require a readiness assessment as necessary to ensure complete health, safety, and environmental reviews prior to work start. This assessment is conducted by people, experienced in similar kinds of work, with the right to examine all aspects of a project about to commence, and require that the project team provide documented evidence that any applicable requirements of the job have been met.

REQUIREMENTS/DRIVERS
Bechtel Jacobs Company LLC Contract DE-AC05-98OR22700, December 18, 1997
Integrated Safety Management System Description, BJC/OR-87, Revision 2
Paducah Gaseous Diffusion Plant RCRA/HSWA Permit Number KY8-890-008-982
Site Management Plan for PGDP, Fiscal Year 00 Annual Revision, November, 1999
NEPA requirements as ARARs.
Integrated Safety Management System Description, BJC-GM-1400, Revision 2, October 2001 and Integrated Safety Management System Supplement, BJC-GM-1401, Revision 0, December 2000"
As applicable, indicate other regulatory-related requirements.
CERCLA: Y RCRA: Y DNFSB: N DOE Orders: Y AEA: N UMTRCA: N State: Y Other: Y

WASTE VOLUMES
Please see attached waste performance metrics, as applicable.
The waste quantities supporting the method of accomplishment and basis of estimate are consistent with data reported on the Waste Profile Metrics Form.

PROJECT SCHEDULE
Please see attached project summary schedule, project detail schedule, and Milestone Status Summary Report.
Schedule assumptions:

BASELINE BY YEAR
Please see attached Baseline by Year Report.